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### (54) PROCESS FOR RECLAIMING VULCANIZED RUBBER

#### (57)Abstract:

PROBLEM TO BE SOLVED: To obtain a novel process for reclaiming a vulcanized rubber whereby fine crushing, high temps., high pressures, and chemical agents are not required by decrosslinking a vulcanized rubber by subjecting it to a mechanical force, such as tension or shearing force, at a low temp. in a nonoxygen atmosphere in the presence of a specified amt. of an unvulcanized rubber, or an uncured polymer.

SOLUTION: A vulcanized rubber in the form of fragments with diameters of about several mm to several tens of mm is mixed with an unvulcanized rubber or an uncured polymer in an amt. of 10 wt.% or higher, pref. 15-30 wt.%, based on the total wt. The mixture is subjected to a mechanical force, such as tension or shearing force, at 40°C or lower, pref. 35°C or lower, in a nonoxygen or low-oxygen atmosphere kept by injecting an inert gas, such as nitrogen or carbon dioxide, into a treating apparatus. Thus, the vulcanized rubber is decrosslinked and reclaimed. The mechanical force can be applied by using an ordinary extruder. The resultant reclaimed rubber can be used similarly to a raw rubber and can be vulcanized again.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the method of \*\*\*\*\* (ing) and reproducing it, in order to use again the rubber which vulcanized and was used for the tire for automobiles etc.

[0002]

[Problem(s) to be Solved by the Invention] Conventionally, in order to reproduce a waste rubber, the method of performing \*\*\*\*\* chemically is learned. However, in reproduction, it is required to crush rubber very minutely, it needs an elevated temperature and high pressure, or uses various chemistry agents further, and cannot say the conventional method as what may be satisfied enough in terms of cost and efficiency.

[0003] Then, this invention is made for the purpose of acquiring the new reproduction method which made unnecessary detailed spallation, an elevated temperature, and high pressure, and made the chemistry agent etc. unnecessary further.

[0004]

[Means for Solving the Problem] this invention is made to apply and \*\*\*\*\* mechanical power, such as tension and shearing force, to vulcanized rubber. Merely, simply, only by applying mechanical power, the molecule of rubber is cut, molecular weight decreases and reproduction use becomes impossible. Then, in this invention, it considers as low temperature and an anoxia state, and little addition of the unvulcanized rubber is further carried out so that a free radical may combine with other rubber molecules easily so that the free radical produced by molecule cutting may combine with oxygen and may not serve as termination of a molecule.

[0005]

[Embodiments of the Invention] Any of synthetic rubber and natural rubber are sufficient as the vulcanized rubber used as a raw material by this invention. Moreover, the unvulcanized rubber may be mixing. Furthermore, carbon black, oil, etc. may be contained. If the equipment which applies mechanical power, such as tension and shearing force, permits a configuration, it is arbitrary, and it is good to usually form in the split whose diameters are a number - about 10 millimeters of numbers. Although the too small powdered thing is inconvenient because of a mechanical process, it is convenient that powder is included in part. Therefore, it can be used as a raw material as it is, without arranging a size by it being old in what judged the waste tire etc. with the easy cutter etc.

[0006] Mechanical extension and processing which applies shearing force can be performed using the usual extruding press machine, and it separates few crevices, may make a special-purpose machinery, for example, a disk and a cylinder, counter, and may be performed by preparing the equipment it was made to make rotate an opposed face relatively.

[0007] This mechanical process is low temperature, namely, 40-degree less than Centigrade, is 35-degree less than Centigrade desirably, and is performed. It is required to operate cooling a processor with cold water etc., since frictional heat occurs and it is easy to become an elevated temperature by the

mechanical process, and in order to suppress generating of heat, it is important to make it not too quick [ an operating speed ]. The composition which prepares water flow space behind an opposed face, and specifically lets cold water pass always with an extruding press machine with the equipment which used an extrusion shaft or casing, the disk, and the cylinder is desirable. This low temperature maintains the state where the viscosity of rubber is high, and is effective in applying mechanical power, such as tension and shearing force, effectively.

[0008] This mechanical process is performed in the state of nothing or hypoxia. Although it is unnecessary that it is zero strictly, as for an oxygen density, it is desirable a thing small as much as possible and that it is 10 or less % in general. When the molecular weight of the completed regenerated rubber is allowed to decrease somewhat from the beginning, you may make an oxygen density comparatively high. Nothing [ this ] or a hypoxia state is realized by pouring in inert gas, such as nitrogen and a carbon dioxide, into a processor. Especially when carrying out continuous running, it is good to pour in this inert gas continuously.

[0009] Furthermore, an unvulcanized rubber is added to the vulcanized rubber of a raw material in this processing. The crude rubber which is not hardened in this unvulcanized rubber may be other suitable and non-hardened polymer. Furthermore, you may be rubber reproduced by this invention. 10 or more percentage by weight of the whole is required for this unvulcanized rubber. This unvulcanized rubber wraps the free radical produced by molecule cutting, this free radical does not make it combine it with these unvulcanized rubber or other free radicals easily, and this effect is not fully acquired as too little. Although it does not produce un-arranging in the property of the completed regenerated rubber when there are many unvulcanized rubbers, since working efficiency will fall, it is good to consider as about 15-30 percentage by weight in general.

[0010] The rubber reproduced by this invention can be used like fresh rubber, and can be vulcanized again. The sulfur content in raw material rubber is chemically shut up in the stable state into regenerated rubber, and is considered to be what does not achieve a hardening operation. In addition, naturally, since the rubber reproduced by this invention contains additives, such as carbon black of raw material rubber, the way which uses, mixing with new rubber is easy to use it and is more practical [ rubber ] rather than carrying out independent use.

[0011]

[Example] Next, the example of this invention is shown.

[0012] As a raw material, what cut the tread of a waste truck tire in a length of 20-40mm, width of face of 10mm, and thickness of 5mm is used. To this, non-hardened synthetic rubber (additives, such as SBR30%, NR70%, carbon black, and oil, are included.) and natural rubber are mixed so that it may become the whole 15 percentage by weight, respectively. It operated having put these in into the extruding press machine which filled the building envelope with nitrogen gas, and supplying nitrogen gas continuously. This operation is performed by a cap's closing a nose of cam, and rotating an extrusion shaft, performing extrusion operation, extruding subsequently, and repeating operation of reversing a shaft. At this time, cold water was held on the casing periphery and through and the interior were held to about 35 Centigrade. The operating speed was considered as per minute 26 sufficiently low speed rotation, and was operated for 8 minutes. Finally, the cap was removed and extruded and regenerated rubber was taken out.

[0013] It was made to mix in non-hardened rubber so that it may become 15 percentage by weight of the whole quantity, and this regenerated rubber was vulcanized, and was used as the finished product. That to which only the non-hardened rubber in which this regenerated rubber is not made to mix vulcanized \*\* as an example of comparison was prepared. The result of comparison is as follows.

Example of comparison Finished-product shore hardness A 64 60 Shore Hardness A (after (700DegreeC and 72 Hours)) 70 65 Elastics Modulus Mpa 2.5 Two Elastics Modulus Mpa (after (700DegreeC and 72 Hours)) 3.325 2.6 (+33%) (+30%)

Tensile strength Mpa 22 18 tensile strength Mpa (after (70degreeC and 72 hours)) 23 It is extended 19. 520% It is extended 480% (after (700degreeC and 72 hours)). 468% 423% tear strength KNm 7.2 6.5 tear strengths KNm (after (70degreeC and 72 hours)) 7.56 7.15 restitution coefficients 38% 39%

compression set (70degreeC, 22 hours) 17% 21% [0014] Putting the above together, in each physical-properties value, although the finished product is falling more slightly than the example of comparison, it is thought substantially that it is equivalent.

[0015]

[Effect of the Invention] Pretreatment of detailed crush etc. of this invention is unnecessary as mentioned above, and its chemistry agent etc. is unnecessary to an elevated temperature and a high-pressure pan, and it can be carried out very easily and cheaply. and the completed regenerated rubber -- a new article -- \*\* -- it can have equivalent physical properties and can be used for the same extensive use as a new article

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[Translation done.]